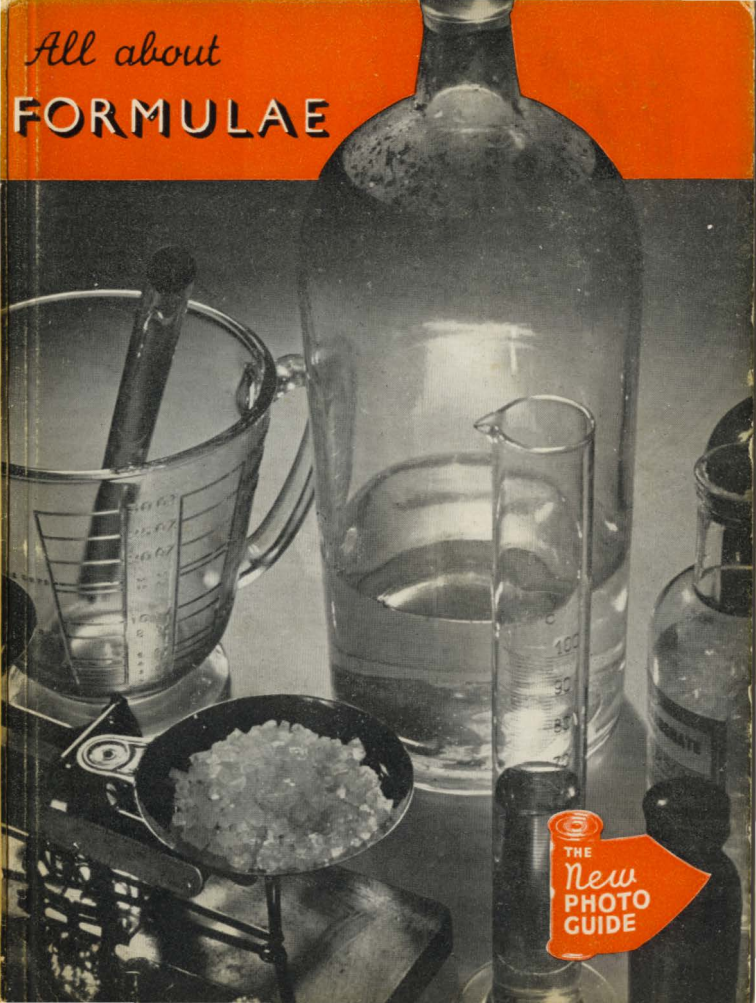
# *All about* FORMULAE



THE *New* PHOTO GUIDE

# THE *new* PHOTO GUIDE

*to better pictures. The help and encouragement you want and just as much as you want of it.*

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*Edited by* A. KRASZNA-KRAUSZ

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**1/6**

C. I. Jacobson

# ALL ABOUT
# FORMULAE
## FOR YOUR DARKROOM

11th—15th Thousand


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# CONTENTS

# PREPARING YOUR OWN SOLUTIONS

Although ready-prepared chemicals of the finest quality are available to suit almost every conceivable purpose in the practice of photography, there are many amateur photographers who prefer to make up their own solutions, either from a point of view of interest, or for reasons of economy. This group of photographers will find in the following pages, a collection of tested and proved formulæ, that has not been compiled on the strength of data obtained from instruction leaflets, etc., but as a direct result of the author's own experience.

## Chemicals and How to Store Them

Preparing photographic solutions is not particularly complicated, but it is essential to use chemicals of a reputable make for the purpose. For economical reasons, the chemicals should *not* be purchased in *too small quantities*, since a glance at any chemical price-list will show that smaller quantities are proportionately dearer than larger ones.

Relative to this, however, is the question of suitable storage for chemicals, and in this direction readers cannot be warned enough against the danger of storing chemicals in paper bags, and still worse in a damp darkroom. The chemical table on page 32 should be consulted with regard to the most suitable form of storage for the various chemicals, whilst it should be taken for granted that each bottle is adequately labelled, so that one does not have to rely on memory.

## Dissolving Chemicals

The chemicals should not be dissolved in a bottle or in the container actually used for development. Several *enamel jugs* holding 1, 2 and 4 pints are excellently suited

to the purpose. Such jugs are available with the inner wall graduated, thus simplifying the making up of solutions. In addition, the solution can be easily warmed over a *gas burner* in this type of container.

Some chemicals are supplied in large crystals or lumps, which dissolve in warm water only with difficulty and waste of time. With the help of a *mortar and pestle* they may be reduced to fine particles by crushing and grinding and will then dissolve more easily ; pounding should not be employed.

The dissolving of chemicals is accelerated by thorough stirring. For this purpose do not use the thermometer, which sooner or later breaks, but one of several *glass rods*.

When preparing most solutions, heating of the solution is recommended ; a *thermometer* ranging from freezing to boiling point, that is 32°—212° F. or 0—100° C., should not be omitted from the outfit. It also serves for testing the temperature of the developer before use. Darkroom thermometers of more restricted range and with bolder divisions may be preferred for use in the actual developers.

*Funnels* should not be missing from the darkroom. Two funnels are sufficient, one three inches and the other four inches in diameter.

For filtering the cut *filter papers* are preferred, since time is wasted with the ordinary sheets. If the solution contains only coarse impurities, filtration with *cotton wool* suffices ; a small wad of cotton wool should be placed loosely in the neck of the funnel.

## Scales, Weights, Graduates

A small pair of *beam scales* with an 8-inch beam weighing up to 2 ounces, is quite suitable for the preparing of small amounts, whilst sundry larger quantities may be split up and weighed in parts. Of course, if the quantity of solution generally demands the weighing of larger amounts, a correspondingly larger pair of scales is better.

If the scales include a set of weights *from one grain to one ounce*, including half a grain, the reader is prepared for all occasions ; in metric weights from one gram to fifty grams, including fractional weights to one tenth of a gram.

The weights should be handled with a *pair of tweezers*, since they are easily soiled and so become inaccurate.

Generally speaking, *three graduates or liquid measures are sufficient*, for one fluid ounce, five fluid ounces, and ten fluid ounces (10, 100 and 250 ccm.). Larger quantities of solution may be measured in parts or in the enamelled jugs used in preparing the solutions.

## Making Up Formulæ . . .

*WATER TO MAKE . . . .*—In nearly all formulæ, particularly those for developers, the last item concerns water to be added for making up the solution to a certain volume. The preparation of the solution, therefore, should as a rule be done with about three-quarters of the full volume of water, and only after all the chemicals have been dissolved, should the remaining quantity of water be added to bring up the solution to full volume. The reason for this procedure is due to the fact that the *chemicals also take up a certain amount of room*, and if the full volume were used in the first case, the ultimate volume of solution would be more than that prescribed in the formula.

*PERCENTAGE SOLUTIONS.*—Similar conditions govern the preparation of a percentage solution. For example, if a 10 per cent. solution of potassium bromide is required, the following procedure is adopted : 10 grams of the substance is dissolved in about 60 c.cm., and the *solution subsequently made up to* 100 c.cm. The incorrect way would be to dissolve 10 grams of substance in 100 c.cm., since in this way a larger volume would be obtained, owing to the chemical bulk.

*DILUTING SOLUTIONS.*—Instructions with regard to diluting concentrated stock solutions are sometimes expressed in a somewhat confusing manner, e.g., for use the solution should be diluted 10 times its volume. These instructions may be interpreted in two ways : either 1 part of solution is to be diluted with 10 parts of water, which will make the full volume 11 parts, or 1 part of solution is to be diluted with 9 parts of water which would mean a full volume of 10 parts. It should be clearly stated whether the solution has to be diluted *to* 10 times or *with* 10 times its volume. In our formulæ the actual number of parts of stock solution to water is clearly indicated, for instance, 1 part of stock solution to 9 parts of water.

## Weights and Measures System

To save conversion, all our formulæ are given in both *Metric* and *Avoirdupois* systems. It is to be noted that the figures given in the Avoirdupois and Metric columns are *not interchangeable* and in making up any formula either one or the other must be adhered to. Whichever system is used the finished solution will have the same composition. It will be seen that a *conventional conversion* has been used which obviates troublesome fractions but does not affect the accuracy or the percentage composition of the solutions when made up.

# DEVELOPERS

The developer usually contains four ingredients as follows :

1. *The developer* substance, e.g., Metol, Hydroquinone, Pyrogallol, Amidol, Paraphenylenediamine.

2. *The preservative*, preventing rapid oxidation of the solution, of which sodium sulphite is by far the most important. Sodium sulphite is obtainable in crystal and in anhydrous form. As will be seen from the formulæ containing sulphite, 2 parts of the crystal are the equivalent of 1 part of the anhydrous form.

3. *The alkali*, which in the majority of developers initiates and accelerates the developing power, usually consists of sodium carbonate or sodium hydroxide. Sodium carbonate is also available in crystal and anhydrous form, $2\frac{2}{3}$ parts of crystal carbonate being equivalent to 1 part of anhydrous carbonate.

4. *The restrainer*, usually potassium bromide.

## Order of Dissolving

It is important to adhere to the order given in the formulæ when dissolving the ingredients of a developer.

Generally speaking, it is best to *dissolve the sulphite first*, since without the preserver the solution is apt to discolour and may lose its effectiveness. An *exception* to this should be observed with all developers containing *metol*, in which cases the metol should be dissolved prior to the sulphite. There is no disadvantage in this procedure, since metol is readily soluble in warm water and does not oxidize rapidly. Nevertheless, the addition of a pinch of sulphite before dissolving the metol is a tip worth remembering. When dissolving, the following rule should also be closely observed.

*Each ingredient must be completely dissolved before the next is added.*

## Temperature When Preparing Solutions

Practically all chemicals have the property of dissolving quicker and easier in *warm water* than in cold, but one must not go too far in this direction and use boiling water. In practice, the temperature of the solution should *not exceed* 125° *F.* (52° *C.*).

The best procedure is to dissolve the chemicals in about *three-quarters of the total volume of warm water*, and when solution is complete make up to full volume by adding cold water.

## Correct Developing Time

The correct time of development is *not only dependent on the formula, but to a large extent on the properties of the film as well.* In order to attain good gradation, some films require a comparatively long developing time ; on the other hand, certain films develop very rapidly. It is, therefore, not possible to stipulate one developing time as being applicable to all films.

As a guide to the reader in determining the developing time, the table on page 9 shows the different types of film divided into *three groups*, according to the developing time required. *Group II* falls into the category of *normal developing time*, and the developing times given with the formulæ refer to this group. Films in the other groups require longer or shorter developing time, according to the details at the top of each group.

*Example :* We choose finegrain developer, page 11. The average developing time for mixtures 1 and 2 is 12 minutes ; this time applies to all films in group II, but if a film in group I has to be developed, the developing time must be curtailed by one-third, so that it amounts to 8 minutes. On the other hand, if the film material belongs to group III the developing time should be prolonged by 50 per cent., which brings it up to 18 minutes. All developing times apply to normal temperature, namely 65° F. (18° C.).

# Films and Development Time

## *GROUP I*

*⅛ of normal development time*

**Agfa-Ansco** Finopan RF, 35 mm.
Plenachrome RF, 35 mm.
Supreme, 35 mm.
Infrared, 35 mm.
Portrait CF

**Barnet Ordinary**

**Defender** Commercial
Fine Grain Pan

**Dupont** Micropan
Parpan

**Gevaert** Fine Grain, 35 mm.
Panchromosa Microgran

**Ilford** Selo Fine Grain Pan RF

**Kodak** Infrared
EF Pan

## *GROUP III*

*Development time 50 per cent longer than with Group II*

**Barnet** Portrait Film
Soft Pan
Super Press
Super Speed Ortho
Ultra Sensitive Pan
XL Super Speed

**Defender** Pentagon
HGS

**Ilford** Golden Iso Zenith

**Kodak** Panatomic XCF
SS Pan CF
Portrait Pan CF
Super XX, 35 mm.
Panatomic X RF
Verichrome RF
Super XX Pan CF

## *GROUP II*

*Normal development time*

**Agfa-Ansco** Standard RF
Superpan RF
Superpan Press RF, CF
Super Plenachrome RF, CF
Ultra Speed Pan
Isopan CF

**Barnet** Self Screen Ortho
Special Rapid
S.R. Pan
Fine Grain Pan
Press
Sensichrome
Standard
Presstopan
Super Iso

**Defender** XF Pan Press
XF Pan
Portrait
XF Ortho

**Dupont** Superior
Infra D

**Ensign** Fine Grain Pan
Ultrachrome

**Gevaert** Rollfilm
Isomax
Panchromosa
Sensima
S.S.S.
Superchrom
Ultra Panchrom
Ultrapress

**Ilford** Selochrome Special Fine Grain, 35 mm.
Selo FP 35 mm.
Selo HP 2, 35 mm.
Auto Filter PI
Iso Zenith PI
Iso Record PI
Double X Press PI
Soft Gradation Panchromatic
Hypersensitive Panchromatic Plate
Portrait Panchromatic F
Hyperchromatic F
Portrait Ortho Fast F
Portrait Medium F
Selo RF
Selochrome RF

**Kodak** Panatomic X, 35 mm.
Plus X, 35 mm.

## Focal Universal MQ Developer

*An all-round developer for negatives and positives, producing brilliant contrast. By varying the dilution, it may be used for dish or tank development. Recommended for all general work as a good single solution developer.*

| | | |
|---|---|---|
| Metol ... ... ... ... ... | 60 grains | 3 grams |
| Sodium sulphite anhydrous ... ... | 3 ounces | 75 grams |
| or crystalline ... ... ... ... | 6 ounces | 150 grams |
| Hydroquinone ... ... ... ... | 220 grains | 11 grams |
| Sodium carbonate anhydrous ... ... | 3 ounces | 75 grams |
| or crystalline ... ... ... ... | 8 ounces | 200 grams |
| Potassium bromide ... ... ... | 20 grains | 1 gram |
| Water to make ... ... ... ... | 40 ounces | 1,000 c.cm. |

*MAKING UP.*—Dissolve the chemicals in the order given in about two-thirds the quantity of water, which has been previously heated to 125° F. (52° C.). Add a pinch of sulphite to the solution before dissolving the metol. After all the chemicals have completely dissolved, make the solution up to full volume. The appearance of a milky turbidity is generally due to the hardness of the tap water used for making up. Allow the solution to stand overnight, then pour off the clear solution, leaving the sediment. Details on how to avoid such a chalky deposit will be found on page 19.

*DILUTION.*—**1.** When undiluted, the developer works rapidly and gives good contrast ; in this form it is recommended for developing process negatives, X-ray films and all materials calling for high contrast. **2.** For dish development of plates and films normal dilution is 1 : 5. But it can be diluted between 1 : 3 and 1 : 7, according to the contrast desired. The higher the concentration, the more rapidly the developer works and the higher the contrast. **3.** For small and large tanks dilute 1 : 10 to 1 : 15. **4.** For gaslight contact papers dilute 1 : 2 to 1 : 3. **5.** For bromide enlarging papers dilute 1 : 5 to 1 : 7.

*TIMES OF DEVELOPMENT.*—The average developing times for the above-mentioned dilutions are as follows : **1.** 3–5 minutes. **2.** 5–7 minutes. **3.** 15–20 minutes. **4.** 45–60 seconds. **5.** 1½–2 minutes.

*KEEPING QUALITY AND USE.*—Both the stock solution and the diluted ready-for-use solution keep well. The developer may be used repeatedly.

## Focal Metol Negative Developer for Soft Results

*This is a soft-working, fairly rapid negative developer, producing good detail in the shadows, and is thus useful for negatives which have been under-exposed. It is employed to advantage when the subject is very*

*contrasty (against-the-light shots, portraits with contrasty lighting effects, etc.), or when the film material in itself tends towards contrast (finegrain films of low sensitivity). As compared with similar soft-working type finegrain developers, this formula possesses the advantage of not requiring additional exposure, although it is not a special finegrain developer.*

| | | |
|---|---|---|
| Metol ... ... ... ... ... | 140 grains | 7 grams |
| Sodium sulphite, anhydrous ... ... | 1½ ounces | 37 grams |
| or crystalline ... ... ... ... | 3 ounces | 75 grams |
| Sodium carbonate, anhydrous... ... | 2 ounces | 50 grams |
| or crystalline ... ... ... ... | 5½ ounces | 135 grams |
| Potassium bromide ... ... ... | 20 grains | 1 gram |
| Water to make ... ... ... ... | 40 ounces | 1,000 c.cm. |

*MAKING UP.*—Similar procedure to that of formula on page 10.

*DILUTION.*—For normal purposes dilute the stock solution 1 : 2 with water, and for very soft gradation 1 : 4.

*TIME OF DEVELOPMENT.*—The image builds up quickly, but with soft gradation ; it is fully developed in 5–6 minutes. If development is prolonged the contrast will be increased.

*KEEPING QUALITIES AND USE.*—Stock and ready-for-use solutions keep well. The diluted solution may be used repeatedly. During the cold months of the year, the stock solution should not be stored in an unheated room, since at low temperatures there is a danger that part of the metol will precipitate as crystalline needles, which are difficult to redissolve, even when the developer is warmed.

## Focal Super-Finegrain Negative Developer

*With this negative developer formula the following types of finegrain developer may be made up :*

**1.** *Without potassium sulphocyanide it provides a normal finegrain developer, and about 50 per cent. additional exposure of the negative is recommended.*

**2.** *Without potassium sulphocyanide but with double the quantity of sodium carbonate (40 grains or 2 grams), it provides a rather more brilliant working finegrain developer than the foregoing one and the same increase in exposure is required.*

**3.** *Exactly as given in the formula it is a super-finegrain developer somewhat slow and soft-working. Double normal exposure is advised.*

**4.** *With potassium sulphocyanide and larger quantity of sodium carbonate as in* **2.** *Super-finegrain developer, giving somewhat steeper gradation than* **3.** *Double normal exposure time.*

| | | | | |
|---|---|---|---|---|
| Water at 125° F. (52° C.) ... ... | 30 | ounces | 750 | c.cm. |
| Metol ... ... ... ... ... | 60 | grains | 3 | grams |
| Sodium sulphite, anhydrous ... | 3½ | ounces | 90 | grams |
| or crystalline ... ... ... | 7 | ounces | 180 | grams |
| Borax crystals ... ... ... | 20 | grains | 1 | gram |
| Sodium carbonate, anhydrous ... | 20 | grains | 1 | gram |
| or crystalline ... ... ... | 50 | grains | 2.6 | grams |
| Glycin ... ... ... ... ... | 100 | grains | 5 | grams |
| Potassium sulphocyanide ... ... | 20 | grains | 1 | gram |
| Potassium bromide ... ... ... | 10 | grains | 0.5 | gram |
| Cold water to make ... ... | 40 | ounces | 1,000 | c.cm. |

REPLENISHER SOLUTION

| | | | | |
|---|---|---|---|---|
| Water at 125° F. (52° C.) ... ... | 30 | ounces | 750 | c.cm. |
| Metol ... ... ... ... ... | 100 | grains | 5 | grams |
| Sodium sulphite, anhydrous ... | 3½ | ounces | 90 | grams |
| or crystalline ... ... ... | 7 | ounces | 180 | grams |
| Borax crystals ... ... ... | 40 | grains | 2 | grams |
| Sodium carbonate, anhydrous ... | 80 | grains | 4 | grams |
| or crystalline ... ... ... | 212 | grains | 10.6 | grams |
| Cold water to make ... ... | 40 | ounces | 1,000 | c.cm. |

*MAKING UP.*—Prepare with warm water and dissolve in the order given. It is essential that the glycin is added only after the sulphite and alkali, otherwise it will not dissolve.

*DILUTION.*—The solution is prepared ready for use. The replenisher is employed when the developer is used in tanks, and serves to keep the volume and properties uniform throughout the useful life of the developer. The replenisher should be added so that the level of the solution in the tank remains constant. As a rule each film absorbs and takes with it about 1 dram (3 c.cm.) of developer solution.

*TIMES OF DEVELOPMENT.*—For **1** and **2**: 10–15 minutes, according to the desired contrast. See page 11. For **3** and **4**: 15–20 minutes, according to desired contrast. See page 11.

*KEEPING QUALITIES AND USE.*—During use, the developer becomes turbid through precipitated silver, but this has no effect on the properties of the developer. Should a deposit settle on the film surface, such may be easily removed before drying by a film wiper, viscose sponge, or similar utensil.

## Focal Maximum Energy Negative Developer

*A negative developer of maximum energy and highest contrast. In these properties it yields far more than the undiluted solution according to formula, page 10, but it possesses the disadvantage of not keeping well once it is mixed. The formula is of good service in all cases where high*

*speed is of importance (press photography) or maximum contrast (process work, X-ray films, etc.).*

SOLUTION A

| | | |
|---|---|---|
| Water at 125° F. (52° C.) ... ... | 14 ounces | 350 c.cm. |
| Hydroquinone ... ... ... | 1¼ ounces | 32 grams |
| Sodium sulphite, anhydrous ... | 1 ounce | 25 grams |
| or crystalline ... ... ... | 2 ounces | 50 grams |
| Phenosafranine 1 : 1,000 solution ... | 1½ drams | 5 c.cm. |
| Potassium bromide ... ... ... | 10 grains | 0.5 gram |
| Cold water to make ... ... | 20 ounces | 500 c.cm. |

SOLUTION B

| | | |
|---|---|---|
| Cold water ... ... ... ... | 14 ounces | 350 c.cm. |
| Potassium hydroxide ... ... | 2 ounces | 50 grams |
| Sodium sulphite, anhydrous ... | 1 ounce | 25 grams |
| or crystalline ... ... ... | 2 ounces | 50 grams |
| Potassium bromide ... ... ... | 10 grains | 0.5 gram |
| Cold water to make ... ... | 20 ounces | 500 c.cm. |

*MAKING UP.*—To make the phenosafranine stock solution, dissolve 10 grains (1 gm.) of dyestuff in 20 fluid ounces (1,000 c.cm.) of warm water, and stir or shake thoroughly. To make solution *A*, dissolve the chemicals in the larger quantity of water, in the order given, and after all chemicals have dissolved thoroughly, fill up with cold water to the full volume. With this formula as well, it is advisable to add a pinch of sulphite to the water, before dissolving the hydroquinone. When making up solution *B*, it should be remembered that potassium hydroxide is a caustic, and should on no account come in contact with the skin. When handling hydroxide in sticks, protect the fingers with a piece of paper, but it is better to use this chemical in flake or pellet form. It should be weighed quickly, since it easily absorbs moisture from the air ; on this account it must be stored in a rubber-stoppered bottle. When dissolving hydroxide in water a considerable amount of heat is evolved, so that only cold water should be used for this purpose. The storage bottle for solution *B* should have a rubber stopper, since the chemical attacks cork, and glass stoppers often remain firm in the neck of the bottle.

*DILUTION.*—**1.** For high-speed development, mix solutions *A* and *B* in equal proportions. This developer also has the quality of bringing out the weakest detail in the shadows ; it is thus suitable for negatives that have been under-exposed. **2.** For maximum contrast, increase the quantity of potassium bromide in solution *A* to ¾ ounce (20 gm.), and mix as follows : 1 part *A*, 1 part *B*, and 2 parts of water, e.g., 1 ounce of *A*, 1 ounce of *B*, and 2 ounces of water.

*TIMES OF DEVELOPMENT.*—Dilution **1** : 20–30 seconds. Dilution **2** : 2½–3 minutes.

*KEEPING QUALITIES AND USE.*—Stock solutions *A* and *B* have unlimited keeping qualities, but when combined deteriorate rapidly. The mixed solution, however, can be used a number of times in succession. An economical way of using this formula is the two-bath method, whereby each solution is employed separately as follows :

High-Speed Development.—Immerse the film in solution *A* for 15–20 seconds, and then without intermediate washing, transfer to solution *B* for about 10 seconds, or until there is no further perceptible growth in image.

Contrast Development.—Increase the quantity of potassium bromide for solution *A*, in accordance with the instructions given hitherto. The film is then immersed in solution *A* for 2 minutes, and in solution *B* for 1 minute.

With the two-bath method, no development whatever takes place in solution *A*, and it is essentially a matter of the emulsion becoming fully saturated with solution during this stage. Solution *A*, therefore, is never chemically exhausted, and may be used to the last drop. The two-bath method is an economical one for *B*, although transferred developer causes solution *B* to discolour, and the solution must be discarded when it assumes a strong brown colour. It is still more economical to use in this way, than mixed with solution *A*.

*REMARKS.*—As the solution *B* is caustic, do not dip bare fingers in the developer ; use plate-holders or rubber fingerstalls. The developer improvers described on page 19 are useful with high-speed formulæ containing a relatively small quantity of bromide, because of their anti-fogging properties. If 3 grains (.2 gm.) are combined with solution *A*, no influence on development speed is observed, but the danger of fogging is eliminated.

## Kodak Tropical Negative Developer

*The composition of this negative developer is similar to formula on page 10, but it has the special property of preventing excessive softening and swelling of the gelatine. This makes it especially suited to development at high temperatures, and particularly for tropical development.*

| | | | |
|---|---|---|---|
| Water (125° F., 52° C.) ... ... | 30 ounces | 750 | c.cm. |
| Metol ... ... ... ... ... | 110 grains | 5.5 | grams |
| Sodium sulphite, anhydrous ... | 3½ ounces | 90 | grams |
| or crystalline ... ... ... | 7 ounces | 180 | grams |
| Kodalk (Kodak) ... ... ... | 1 ounce | 25 | grams |
| Potassium bromide ... ... ... | 40 grains | 2 | grams |
| Sodium sulphate, crystals ... ... | 4 ounces | 100 | grams |
| Cold water to make ... ... | 40 ounces | 1,000 | c.cm. |

*MAKING UP.*—Dissolve the chemicals in the order given.

*DILUTION.*—The solution is ready for use.

*TIMES OF DEVELOPMENT.*—The most suitable times of development for the various temperatures are :

| TEMPERATURE | | DISH | TANK |
|---|---|---|---|
| Deg. F. | Deg. C. | Minutes | Minutes |
| 65 | 18 | 10 | 12½ |
| 70 | 21 | 8 | 10 |
| 75 | 24 | 6½ | 8 |
| 80 | 27 | 5 | 6 |
| 85 | 30 | 3¾ | 4½ |
| 90 | 32 | 2½ | 3 |

At the beginning of development it is essential to agitate the films repeatedly, so that uneven development is avoided.

*KEEPING QUALITIES AND USE.*—When development is complete rinse the film in water for 1 or 2 seconds, and then immerse in the following tropical hardening bath for 3 minutes :

| | | |
|---|---|---|
| Water ... ... ... ... ... | 40 ounces | 1,000 c.cm. |
| Potassium chrome alum ... ... | 1¼ ounces | 30 grams |
| Sodium sulphate crystals ... ... | 4 ounces | 100 grams |

In half-watt lighting this hardening bath is a violet-blue colour ; when it assumes a yellow-green, it ceases to harden and should be replaced with a fresh bath.

Rinsing between hardening and fixing may be omitted, if there is some danger of the emulsion becoming too soft ; otherwise a rinse is advisable.

For fixation, a hardening fixing bath is used. See page 22.

The temperature of the washing water should not exceed 95° F. (35° C.).

*REMARKS.*—Finegrain developers, such as that mentioned on page 11, may be employed as tropical developers, providing a similar quantity of sodium sulphate is added.

## Amidol Universal Developer

*As a negative and positive developer amidol enjoys a certain popularity, on account of its freedom from fog, good tonal reproduction and universal use, as well as its capacity for producing a deep velvety black on bromide paper. It is possible, however, to achieve similar results with the various types of Focal MQ Universal Developer, which have the additional advantage of better keeping qualities.*

STOCK SOLUTION

| | | |
|---|---|---|
| Sodium sulphite, anhydrous ... | 1 ounce | 25 grams |
| or crystalline ... ... ... | 2 ounces | 50 grams |
| Potassium bromide ... ... ... | 20 grains | 1 gram |
| Water to make ... ... ... | 40 ounces | 1,000 c.cm. |

*For use*, take 4 ounces (100 c.cm.) of stock solution and add :

| | | |
|---|---|---|
| Amidol ... ... ... ... ... | 10 grains | 0.5 grams |

*MAKING UP.*—Dissolve the chemicals in the order given. It is advisable to add the amidol to the stock solution just before the developer is to be used.

*DILUTION.*—The solution is ready for use.

*TIMES FOR DEVELOPMENT.*—**1.** For plates and films : 3–5 minutes. The image appears quickly, but the negative must be thoroughly developed, since the density tends to weaken in the fixing bath. **2.** For bromide papers : 1½–2 minutes. **3.** For gaslight contact papers : 45–60 seconds.

*KEEPING QUALITIES AND USE.*—A solution containing amidol does not keep more than 2–3 days ; it is best, therefore, to make up a stock solution as described, the amidol can then be added immediately before use and no more solution made up than is required at the moment.

*REMARKS.*—As amidol developer contains no sodium carbonate, it does not tend to soften the gelatine of the emulsion ; it is, therefore, suitable as a tropical developer.

## Focal Paper Developer

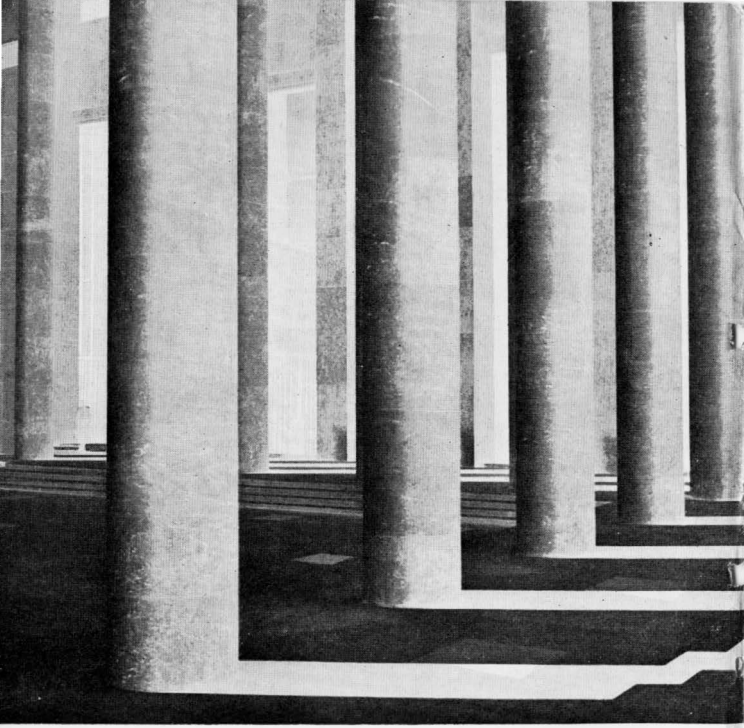
*An inexpensive and generally useful positive developer for both printing and enlarging papers. The formula is of good service when the photographer desires one developer to suffice for all purposes, thus avoiding the preparation of a special formula for each type of paper.*

| | | |
|---|---|---|
| Metol ... ... ... ... ... | 40 grains | 2 grams |
| Sodium sulphite, anhydrous ... | 1 ounce | 25 grams |
| or crystalline ... ... ... | 2 ounces | 50 grams |
| Hydroquinone ... ... ... | 60 grains | 3 grams |
| Sodium carbonate, anhydrous ... | 1 ounce | 25 grams |
| or crystalline ... ... ... | 2¾ ounces | 67.5 grams |
| Potassium bromide ... ... ... | 20 grains | 1 gram |
| Water to make ... ... ... | 40 ounces | 1,000 c.cm. |

*MAKING UP.*—This developer is prepared in a similar way to all other M-Q developers. See page 10.

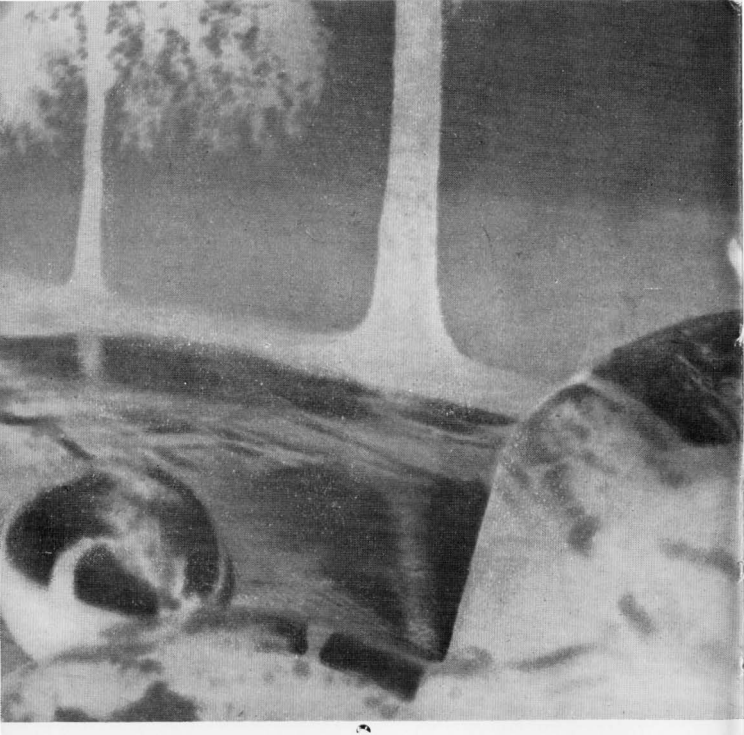
*DILUTION.*—The solution is ready for use. Only for enlarging paper giving warm-black tones by direct development, should the solution be diluted with an equal quantity of water.

*EVERYTHING IN THE NEGATIVE. Judicious choice of a developer was necessary to ensure that even the finest details in the background were correctly rendered. A picture showing such fine detail should never be developed in an energetic developer. Developer and developing should be suited to the negative material and give a soft, delicate negative image. In this case a choice should be made between a solution of Focal Universal MQ Developer (Dilution 2) (p. 10), Focal Metol Developer for Soft Results (p.10), and Focal Super-Finegrain Developer (p. 11).*—J. DIXON SCOTT.



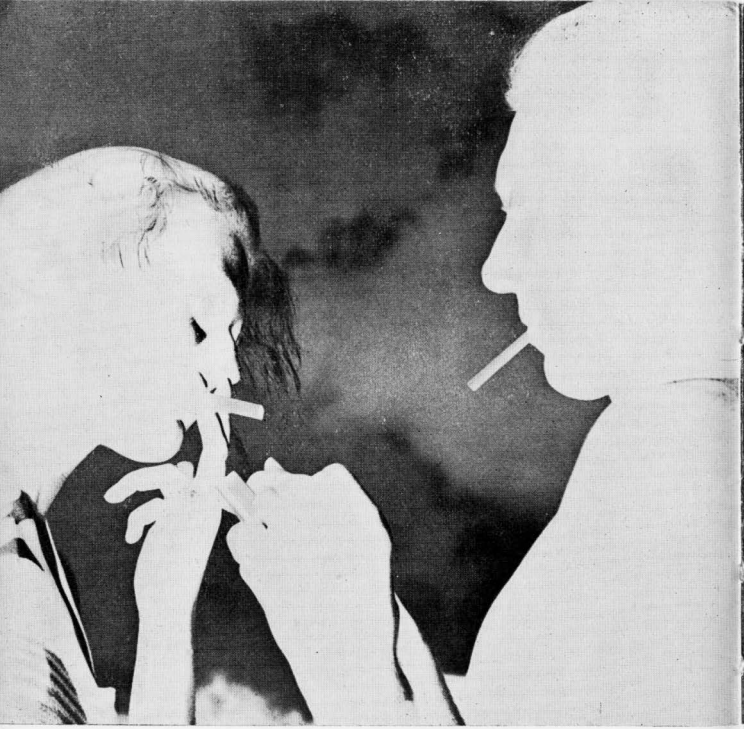
*NORMAL NEGATIVE : NORMAL DEVELOPMENT. Correctly exposed and developed negative* (**above**) *with print* (*p. 19*). *The deepest shadows are not black and blotchy, but show a certain amount of detail ; the high-lights are correct, all half-tones clearly rendered. Such a picture, in which such a correct and natural scale of contrast is reproduced, depends on the right*

*choice of film and the correct method of development (according to the time-table on page 9). When film and development are not suited to one another, no picture like this can be produced. Here a group II film has been developed with Focal Universal MQ Developer, Dilution 3 (p. 10), for about 16 minutes.*—L. PALMER.



*SOFT NEGATIVE : NORMAL OR SOFT DEVELOPMENT. Mist or fog blur the contours, as though a thin veil were hung over the landscape. In developing, one must endeavour to retain this soft and fading effect. No contrasty developer should be used, but one that works softly. Focal Universal MQ Developer, Dilution 2 (p. 10) is quite suitable, but if softer results are desired choose Focal Developer for Soft Results (p. 10). Close*

*attention should be paid to whether the temperature and developing time are correct, since prolonged developing again results in higher contrast. If the contrast in this particular picture were increased, the trees along the road would come out in silhouette and the misty impression would be lost.*—A. RUMBUCHER.



*HARD NEGATIVE : NORMAL OR CONTRASTY DEVELOPMENT. The negative is under-exposed in the shadows, consequently there is scarcely any detail to be seen. An energetic developer, Focal Universal MQ, Dilution 1 (p. 10) was used, which brought out the correctly exposed high-lights satisfactorily, although naturally nothing could be done with the shadow portions where there is no image to develop. The result is a semi-silhouette effect (p. 23).*—H. GORNY.

*HARD NEGATIVE : SOFT DEVELOPMENT* (p. 24). *Had an energetic developer been used, the shadows on the face would have stood out black against glaring white high-lights : the high-lights would simply have been white patches, and the fine half-tones of the flesh would have vanished altogether. Focal Developer for Soft Results, Dilution 1 : 4 (p. 11) can be used and the negative very carefully developed, so that the high-lights are not lost, and the shadows show detail.*—L. H. LEIGH.

*TIMES OF DEVELOPMENT.*—**1.** Contact printing papers (gaslight) : 1 minute. **2.** Enlarging papers (chlorobromide and bromide) average 2 minutes.

## Focal Paper Developer for Blue-Black Tones

*Energetic positive developer giving vigorous results. Producing pure black to blue-black tones on chloride paper, and pure black tones on bromide enlarging paper.*

| | | |
|---|---|---|
| Metol ... ... ... ... ... | 40 grains | 2 grams |
| Sodium sulphite, anhydrous ... | 1 ounce | 25 grams |
| or crystalline ... ... ... | 2 ounces | 50 grams |
| Hydroquinone ... ... ... | 120 grains | 6 grams |
| Sodium carbonate, anhydrous ... | 1½ ounces | 37.5 grams |
| or crystalline ... ... ... | 4 ounces | 100 grams |
| Potassium bromide ... ... ... | 10 grains | 0.5 grams |
| Water to make ... ... ... | 40 ounces | 1,000 c.cm. |

*MAKING UP.*—Similar to formula, page 10.

*DILUTION.*—The solution is ready for use.

*TIMES OF DEVELOPMENT.*—**1.** For contact printing papers (gaslight) : 45–60 seconds. **2.** For enlarging papers (chlorobromide and bromide) : 1½–2 minutes.

*KEEPING QUALITIES AND USE.*—The solution keeps well and is very economical in use.

*REMARKS.*—To increase the capacity of the developer for blue-black tones on contact printing papers (gaslight), and pure black tones on enlarging papers (bromide), add a developer improver.

## Focal Paper Developer for Warm-Black Tones

*This positive developer is suitable for all papers, which are intended to give warm-black tones, e.g., chamois contact paper (gaslight), portrait contact and enlarging papers (chlorobromide).*

| | | |
|---|---|---|
| Metol ... ... ... ... ... | 40 grains | 2 grams |
| Sodium sulphite, anhydrous ... | 1½ ounces | 37.5 grams |
| or crystalline ... ... ... | 3 ounces | 75 grams |
| Hydroquinone ... ... ... | 120 grains | 6 grams |
| Sodium carbonate, anhydrous ... | 1½ ounces | 37.5 grams |
| or crystalline ... ... ... | 4 ounces | 100 grams |
| Potassium bromide ... ... ... | 40 grains | 2 grams |
| Sodium chloride ... ... ... | 100 grains | 5 grams |
| Water to make ... ... ... | 40 ounces | 1,000 c.cm. |

*MAKING UP.*—Similar to any MQ developer (see page 10).

*DILUTION.*—In general, the desired warm tones are produced by the undiluted solution, but with some papers, dilution with an equal quantity of water is recommended, otherwise the tones may be too cold.

*TIMES OF DEVELOPMENT.*—**1.** For contact papers : 1½ minutes. **2.** For enlarging papers : 2½–3 minutes.

*REMARKS.*—The qualities of the developer may be enhanced by the addition of a developer improver.

## Focal Paper Developer for Brown Tones

*Positive developer. When a brown-tone developer of this type is used, it does not mean that brown tones will be produced on any paper ; not all papers are suitable for brown tones. This developer should be used for those papers which are especially designed to produce brown tones, as will be indicated on the label or instruction leaflet.*

| | | | |
|---|---|---|---|
| Hydroquinone ... ... ... | 160 grains | | 8 grams |
| Sodium sulphite, anhydrous ... | 2 ounces | | 50 grams |
| or crystalline ... ... ... | 4 ounces | | 100 grams |
| Sodium carbonate, anhydrous ... | 1¼ ounces | | 30 grams |
| or crystalline ... ... ... | 3 ounces | | 75 grams |
| Potassium bromide ... ... ... | 20 grains | | 2 grams |
| Ammonium bromide ... ... | 20 grains | | 2 grams |
| Water to make ... ... ... | 40 ounces | | 1,000 c.cm. |

*MAKING UP.*—Dissolve the chemicals in tepid water in the order given. Before adding the ammonium bromide the solution must be cooled to normal temperature.

*DILUTION.*—The resultant degree of brown tone is dependent on (*a*) dilution of the developer, (*b*) the degree of over-exposure, and (*c*) the time of development. We may say that the tone becomes warmer as the dilution of the developer is increased, the exposure time lengthened, and the development time prolonged. These operations, however, should not be carried too far, otherwise the gradation will become too soft. The following details will serve as a guide : **1.** Undiluted : black-brown to sepia. **2.** 1 part developer to 1 part water : brown. **3.** 1 part developer to 3–5 parts water : red-brown.

*TIMES OF DEVELOPMENT.*—For the three concentrations mentioned above, the following developing times are approximately correct : **1.** 2 minutes. **2.** 3 minutes. **3.** 4–5 minutes.

*KEEPING QUALITIES AND USE.*—The solutions keep well, but in the interests of consistent results do not use until completely exhausted.

# VARIOUS DEVELOPER AUXILIARIES

## Prevention of Lime Deposits

When the developer is prepared with tap water, the solution usually appears cloudy, which fact is due to the lime salts of the water combining with alkali and forming a precipitate. This turbidity has no effect on the properties of the developer, but if the lime content of the water is high, it may result in an unpleasant deposit on the surface of the film. In such cases the chalk precipitate should be allowed to settle, or the solution should be filtered before use. The formation of lime deposit may be avoided by the addition of certain substances to the developer.

The following are recommended :

*CALGON* (sodium hexametaphosphate).—10 grains to 20 fluid ounces (1 gm. to 1 litre) should be included when the sulphite is added to the developer solution.

*SODIUM METAPHOSPHATE.*—Prepare a 1 : 10 solution and add 1 dram per 20 fluid ounces (3–5 c.cm. per litre) to the water that is to be used for making up. It is essential that this solution is added to the tap water and not to the ready-made developer.

## Developer Improvers

These chemicals, which should be added to the developer in quantities from 1 to 2 grains per 20 fluid ounces (.1 to .2 gm. per litre), impart to the developer valuable additional properties. They have strong anti-fogging properties. With development papers, developer improvers produce purer and deeper image tones. Developer improvers help to maintain the tone and brilliance of a print, which has received longer or shorter development time, owing to incorrectly estimated exposure. Thus the latitude of the paper is increased, and waste is reduced.

There is a number of developer improvers on the market, and choice should be made according to the type of material (film, printing or enlarging paper) and the required image tone.

## Desensitizers

Desensitizing is a process whereby the sensitivity of a plate or film is depressed, so that the development can take place by a brighter darkroom illumination. At the present time the following desensitizers are available :

## Desensitizers with Dyeing Properties

The most popular member of this group is phenosafranine (Pinasafrol, Desensitol), which forms a very effective desensitizer, although it has the drawback of staining the emulsion and fingers. Stock Solution :

| | | |
|---|---|---|
| Phenosafranine ... ... ... | 20 grains | 1 gram |
| Water ... ... ... ... ... | 80 ounces | 2,000 c.cm. |

*For use*, dilute with 4 parts of water. Immerse the film in this solution for not less than 1 minute before development.

## Coloured Desensitizers

Though they are slightly coloured, they do not stain the film. Pinacryptol green belongs to this group. Stock Solution :

| | | |
|---|---|---|
| Pinacryptol green ... ... ... | 20 grains | 1 gram |
| Water ... ... ... ... ... | 40 ounces | 1,000 c.cm. |

*For use*, dilute with 4 parts of water, and immerse the film for 2 minutes before development.

## Colourless Desensitizers

The latest advance in the technique of desensitization is the colourless form, such as :

*PINA WHITE.*—Dissolve 1 tablet of Pina White in 20 c.cm. of warm water (about $\frac{3}{4}$ oz.). After cooling, pour this solution into 500 c.cm. (20 ounces) of developer.

*QUALITOL.*—This is sold in the form of a clear colourless solution which is diluted with 20 parts of water for use. Plates or films are bathed in the dilute solution for 2 minutes and then passed into the developer without rinsing. Development can be observed by using an Ilford Bright Green Safelight in which a 15-watt lamp provides light. The dark-room lamp should be some 6-8 feet away from the developer dish or tank.

*DESENSITIZING YELLOW.*—It is sold in 1 gram tubes (15$\frac{1}{2}$ grains). The contents of a tube, a fine yellow powder, is dissolved in 40 ounces (1 litre) of boiled water. When solution is complete the solution is made up to 80 ounces (2 litres) with cold water and is then ready for use. Bathe for 2 minutes and then proceed as described for Qualitol.

# FIXING, WASHING, DRYING

## Stop-Bath

Sodium thiosulphate, commonly known as hypo, and the main ingredient of a fixing bath, is, in itself, a perfectly harmless chemical, but it can give the photographer a large amount of trouble if it is not handled with reasonable care. Hypo crystals or spots of fixing bath must be carefully removed from any dishes or from the work-bench. Splashes of fixing bath in the developer or on the light-sensitive emulsion will lead to trouble, which cannot be overcome. As hypo has a cooling effect on the solution, it should be seen that warm water is used to dissolve it.

*Developers and fixing baths do not agree with one another, hence it is necessary to remove as much as possible of the developer from the negative before it is placed in the fixing bath. If this is not done, developer in the fixing bath can affect its working, shorten its life and give rise to a number of troubles. In certain cases development may even continue in the fixing bath.*

Sometimes a stop-bath is used instead of or as an auxiliary to the rinse ; this is a bath containing about 2 *per cent. of acetic acid.*

## Acid Fixing Bath

*This formula is generally suitable for plates, films and papers.*

| | | |
|---|---|---|
| Water ... ... ... ... ... | 40 ounces | 1,000 c.cm. |
| Hypo crystals ... ... ... ... | 10 ounces | 250 grams |
| Potassium metabisulphite ... ... | ¾ ounce | 20 grams |
| or | | |
| Sodium bisulphite ... ... ... | ¾ ounce | 15 grams |
| or | | |
| Sodium bisulphite lye ... ... | 1½ ounces | 40 c.cm. |

*MAKING UP.*—The hypo solution should not be warm, when the other ingredient is added.

*WORKING INSTRUCTIONS.*—A 40-ounce (1 litre) bath will safely fix about 20 plates or films 10 × 8 inches. Other plate or film sizes will be in proportion :

## CAPACITY OF A FIXING BATH

| *Size of Negative* | *Number which can be fixed in 40 ounces (1 litre) of freshly made-up bath* |
|---|---|
| 8 × 10 inches ... ... ... ... ... | 20 |
| $8\frac{1}{2}$ × $6\frac{1}{2}$ ,, (whole plate) ... ... ... | 30 |
| $6\frac{1}{2}$ × $4\frac{3}{4}$ ,, ($\frac{1}{2}$-plate) ... ... ... | 60 |
| $4\frac{1}{4}$ × $3\frac{1}{4}$ ,, ($\frac{1}{4}$-plate) = 9 × 12 cm. ... | 100 |
| $2\frac{1}{4}$ × $3\frac{1}{4}$ ,, = 6 × 9 cm. ... ... | 160 |
| $1\frac{5}{8}$ × $2\frac{1}{2}$ ,, = 4 × 6.5 cm. ... ... | 320 |
| $1\frac{1}{2}$ × 1 ,, = 24 × 36 mm. ... ... | 1,000 |

Note that these figures should be taken as a safe maximum. In the case of roll films the number of negatives is given by multiplying the spools by the number of exposures, for example, 120 spools $2\frac{1}{4}$ × $3\frac{1}{4}$ with 8 exposures will yield 160 negatives.

*AVERAGE FIXING TIMES.*—Plates and films : 10 minutes. Papers : 5 minutes.

## Acid Hardening-Fixing Bath

*A hardening-fixing bath is not only useful at higher temperatures (see page 15), but also offers advantages at normal temperature, since its hardening effect gives the emulsion better protection against scratching, also the drying process may be accelerated as the emulsion will stand a much higher drying temperature.*

| | | |
|---|---|---|
| Water ... ... ... ... ... | 40 ounces | 1,000 c.cm. |
| Hypo crystals ... ... ... ... | 12 ounces | 300 grams |

Add to this solution 10 ounces (250 c.cm.) of the following hardening bath :

| | | |
|---|---|---|
| Water at 125° F. (52° C.) ... ... | 10 ounces | 250 c.cm. |
| Sodium sulphite, anhydrous ... | 1 ounce | 25 grams |
| or crystalline ... ... ... | 2 ounces | 50 grams |
| Acetic acid 28 per cent. ... ... | 4 ounces | 100 c.cm. |
| Boric acid crystals ... ... ... | $\frac{1}{2}$ ounce | 12.5 grams |
| Potash alum ... ... ... ... | $1\frac{1}{4}$ ounces | 32 grams |
| Cold water to make ... ... | 40 ounces | 1,000 c.cm. |

*MAKING UP.*—To prepare the 28 per cent. acetic acid solution, dilute 3 parts of acetic acid glacial (as purchased) with 8 parts of water. Stir thoroughly as the hardening solution is added to the hypo, and in no circumstances must the hypo be dissolved simultaneously with the other chemicals, since in this way precipitates are likely to form.

*AVERAGE FIXING TIMES.*—Similar to the acid fixer mentioned on

page 21. As a fairly reliable guide to the correct time of fixation, this is usually taken as twice the time for the milkiness or opalescence of the unreduced silver salts in the film to disappear.

## Quick Washing

To accelerate the removal of hypo from the emulsion, proceed as follows : First, wash the negative for 5 minutes in running water or a number of changes of water. Then fill a dish with water and add a few drops of potassium permanganate solution until the water assumes a pale pink colour. When the negative is immersed in this solution, the pink colour either disappears, or changes into a yellow-brown ; negative and dish should then be rinsed, and the process repeated until immersion of the negative does not change the colour of the solution. When this stage is reached, leave the negative in the solution for 2 minutes, after which wash the negative in water for 2 minutes. If the permanganate solution is too strong, it will stain the negative a pale brown, but this may be removed by dipping the negative in a 5 per cent. solution of potassium metabisulphite.

## Quick Drying

The negative is immersed in a bath of methylated spirit, which has been mixed with 10 per cent. water.

## Hardening and Scratch-Proofing

*If the emulsion is hardened according to No.* **1** *method, the drying process may be shortened by using a higher temperature. This method also gives the emulsion greater protection against mechanical damage. With No.* **2** *method the principal feature is that of making the emulsion scratch-proof and friction-resisting.*

| | | |
|---|---|---|
| **1** *Method* (Crabtree and Russell) | | |
| Water ... ... ... ... ... | 40 ounces | 1,000 c.cm. |
| Formaldehyde 40 per cent. solution | 1 ounce | 25 c.cm. |
| Sodium carbonate, anhydrous ... | 170 grains | 8.5 grams |
| or crystalline ... ... ... | 1 ounce | 25 grams |
| **2** *Method* (R. B. Willcock) | | |
| Tannic acid ... ... ... ... | 120 grains | 6 grams |
| Hot water ... ... ... ... | 10 ounces | 250 c.cm. |
| When cold and the solution is clear, add : | | |
| Formaldehyde 40 per cent. solution | 1 ounce | 25 c.cm. |

*WORKING INSTRUCTIONS.*—After thorough washing, immerse the negative for 3 minutes in bath No. **1**, then wash again. No. **2** method : mix the solution of No. **2** with 15 parts of water, immerse film for **5** minutes and finally wash.

# IMPROVING NEGATIVES

Negatives that have been incorrectly exposed or developed may be improved to some extent by after-treatment with a reducer or an intensifier, although, of course, it is better to eliminate such treatment where possible, by careful selection of exposure and development.

For reduction, *Farmer's Reducer* is perhaps the most used ; it is simple to use, although it is essential to store the two solutions separately, and only combine them immediately before use. Make sure that plain hypo is used and not that from an acid fixing bath.

With both reducers and intensifiers it is important to see that the negative is perfectly free from fixing bath, in order to avoid any irregular action of the treatment.

## Farmer's Reducer

*This reducer has a greater effect on the shadow portions than on the half-tones and highlights of a negative ; it should be used primarily to clear shadows of veil caused by over-exposure or over-development. Negatives showing too much density in the highlights, and scarcely any detail in the shadows, should not be treated with this reducer.*

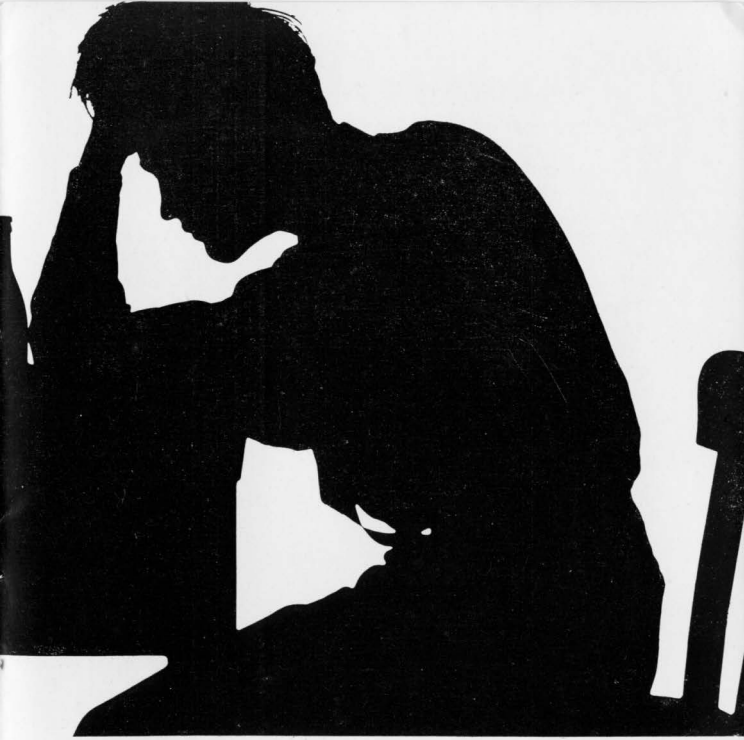
| | | |
|---|---|---|
| **SOLUTION A** | | |
| Water ... ... ... ... ... | 20 ounces | 500 c.cm. |
| Hypo crystals ... ... ... ... | 4 ounces | 100 grams |
| **SOLUTION B** | | |
| Water ... ... ... ... ... | 20 ounces | 500 c.cm. |
| Potassium ferricyanide ... ... | 2 ounces | 50 grams |

*WORKING INSTRUCTIONS.*—The stock solutions have good keeping qualities (store solution B in a brown bottle), but the ready-mixed solution only keeps for a short time. Immediately before use, mix as follows :

| | | |
|---|---|---|
| Water | 5 ounces | 100 c.cm. |
| Solution **A** ... ... ... ... | 5 ounces | 100 c.cm. |
| Solution B ... ... ... ... | $\frac{1}{4}$ ounce | 5 c.cm. |

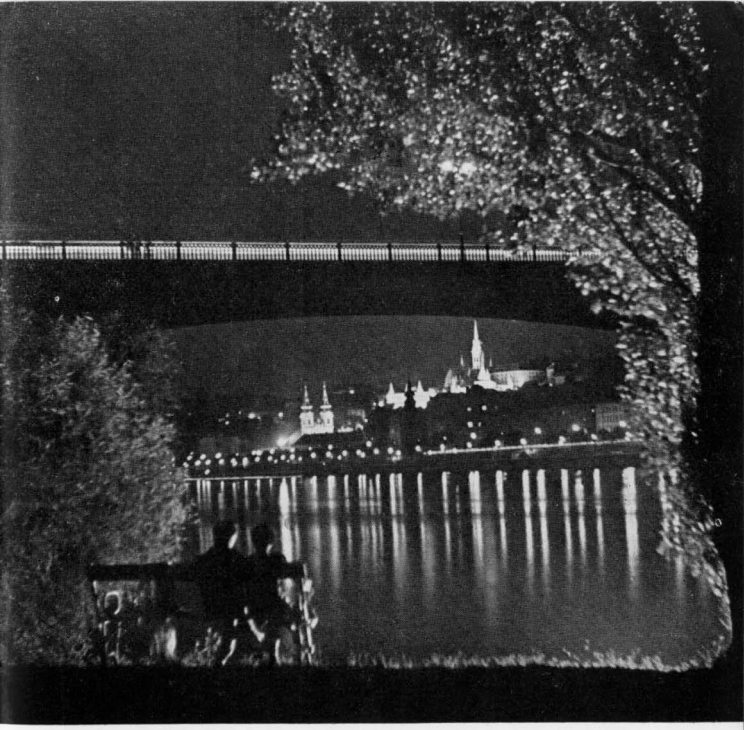
Reduction may take place immediately after fixation, and only a short intermediate wash of 5 minutes is necessary.

The action of the reducer increases and becomes more effective as the proportion of solution B is increased. The density of the negative should be checked at short intervals, say every 20 seconds, and as soon as the required degree of reduction is reached, rinse the negative at once and leave to wash thoroughly.

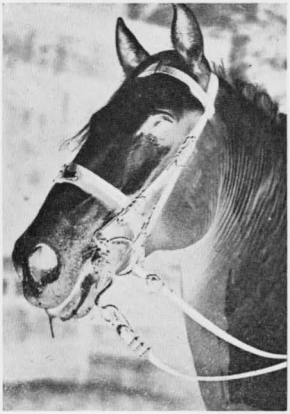


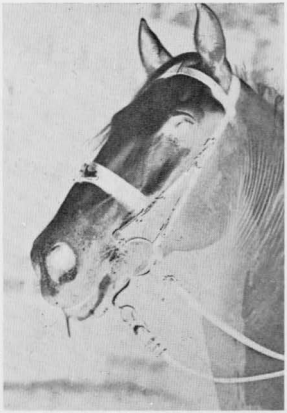
*HARD NEGATIVE : CONTRASTY DEVELOPMENT. A silhouette is only effective when it is completely black against a white background. The shadows must not show any details and the background must not be grey and veiled, but pure white. The highest contrast, then, is necessary : black against white. Focal Maximum Energy Developer (p. 12) is recommended.*—REIMANN SCHOOL.

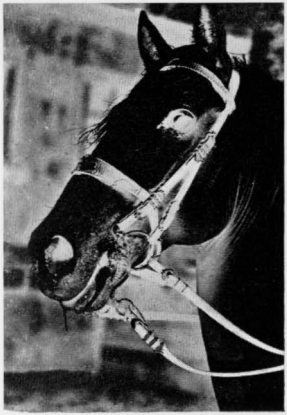
*DEVELOPING OF SNOW SCENES. To develop contrasty pictures like this, it would be a mistake to use a brilliant-working developer. It would probably produce a loss of details in the snow and the snow would certainly lose its translucence. The Focal Fine Grain Developer Type I (p. 11) with its delicate-working modification is the developer to use in such cases. Every brilliant-working developer would result in a hard and unprintable negative.*
—P. WOLFF.



*DEVELOPING NIGHT SCENES. In night scenes, the lights usually show more halation the longer the negative has been developed. A certain amount of halation is often necessary to give a natural result, therefore night scenes should be developed with a surface developer, such as the Focal Fine Grain Developer Type 3* (p. *19*). *The characteristic halation of the lights, although not very marked, will then produce the natural impression of artificial lighting at night, as we really see it with our eyes.*—L. DULOVITS.

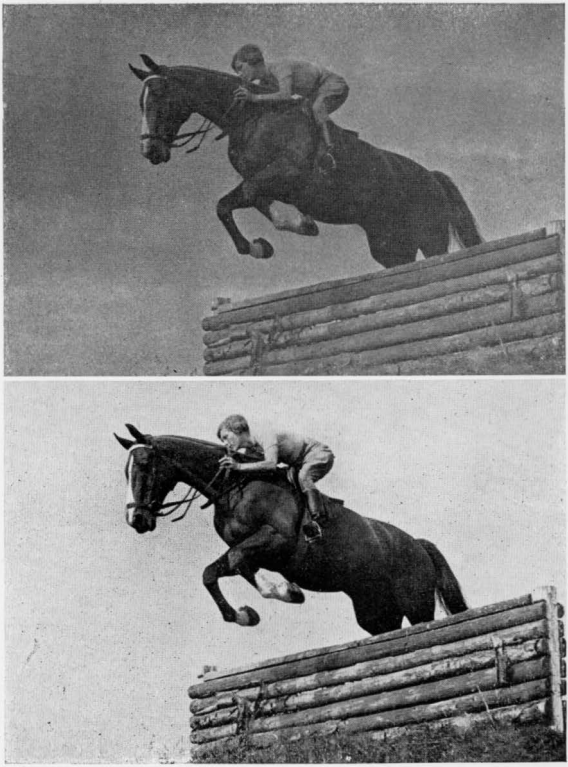






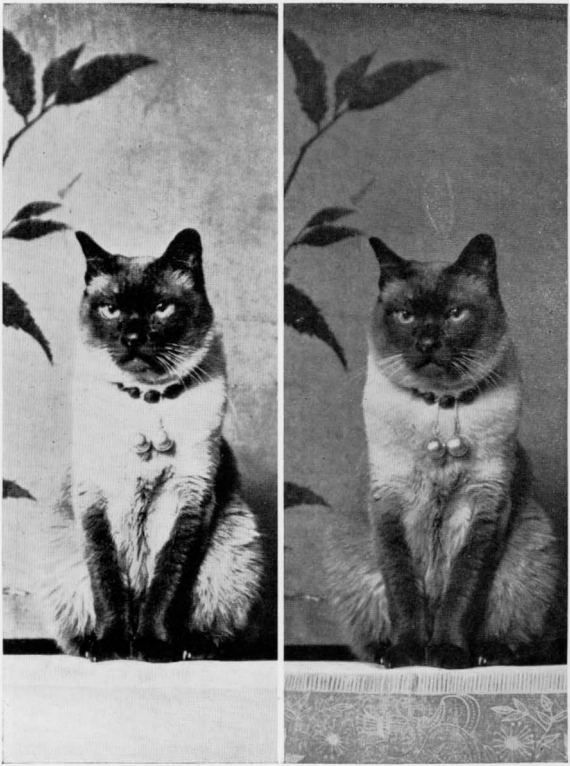
*THE CORRECT DEVELOPING TIME. The influence of developing time on the negative image is illustrated here. The* **top left** *picture shows a correctly exposed and developed negative, the* **top right** *picture received correct exposure but was under-developed, and the* **bottom** *picture also had correct exposure but was over-developed. The under-developed negative may be treated with Chromium Intensifier (p. 42), and the over-developed one with Farmer's Reducer (p. 32).*—C. I. JACOBSON.

*FINE GRAIN DEVELOPMENT. A comparison showing an image developed with fine grain developer* (**top**), *and with ordinary developer* (**bottom**).



*INTENSIFICATION. Under-exposed negatives contain all details, but are flat. Resort must be made to negative intensification (pp. 41-42).*

*REDUCTION WITH FARMER'S REDUCER. Farmer's Reducer* (p. 32) *lessens the density of over-developed negatives, makes them more transparent, free from fog, and printable on a soft grade of paper.*



*REDUCTION WITH PERSULPHATE. The high-lights wanted reducing, and this was done with Persulphate Reducer (p. 41).*

## Persulphate Reducer

*This reducer has the property of attacking the highlights (the denser portions) more readily than the half-tones and shadows ; it is suitable, therefore, for the reduction of hard negatives. This is a somewhat unreliable reducer, owing to its variable quality and poor keeping properties. It is for this reason that many workers prefer the redevelopment method* (see page 27).

| | | |
|---|---|---|
| Distilled water ... ... ... | 4 ounces | 100 c.cm. |
| Ammonium persulphate ... ... | 50 grains | 2.5 grams |
| Ammonia solution 0.91 sp. g. ... | 40 minims | 2 c.cm. |
| Hypo crystals ... ... ... ... | 50 grains | 2.5 grams |

*WORKING INSTRUCTIONS.*—The solution is ready for use. Make a rule of thoroughly fixing and washing all negatives which have to be subsequently treated with persulphate. The action of the reducer on the negative emulsion produces a cloudiness, particularly in the dense portions ; this is an indication that the reducer is taking effect, and from its commencement the negative should be inspected every 15 seconds. The reducer often takes a little time to start, but once it does the action is rapid. The negative should be removed from the bath just before the required degree of reduction is reached, since the reducer continues to work, until its action is arrested by the following bath :

| | | |
|---|---|---|
| Water ... ... ... ... ... | 4 ounces | 100 c.cm. |
| Sodium sulphite, anhydrous ... | ½ ounce | 12.5 grams |
| or crystalline ... ... ... | 1 ounce | 25 grams |

After short rinse, immerse the film in the above bath for about 2 minutes. Thorough washing should follow.

*REMARKS.*—When being dissolved, the ammonium persulphate crystals should crackle ; if this does not happen, there is a possibility of the chemical not being fresh.

## Uranium Intensifier

*Treatment with this solution results in strong intensification, partly due to the yellow-brown colour of the negative; the effect of intensification is not so appreciable if printing and enlarging papers are sensitive to yellow-green. Some modern enlarging papers are distinctly colour sensitive.*

SOLUTION A

| | | |
|---|---|---|
| Water ... ... ... ... ... | 4 ounces | 100 c.cm. |
| Uranium nitrate ... ... ... | 20 grains | 1 gram |
| Acetic acid glacial ... ... ... | ½ ounce | 12.5 c.cm. |

SOLUTION B

| | | |
|---|---|---|
| Water ... ... ... ... ... | 4 ounces | 100 c.cm. |
| Potassium ferricyanide ... ... | 20 grains | 1 gram |

*WORKING DIRECTIONS.*—Combine 1 part of solution *A* with 2 parts of solution *B*, and intensify negative to required degree. Then wash negative in running water until the water runs smoothly off the negative surface ; on the other hand, washing should not be over long, since this lessens the degree of intensification. Yellow discoloration of the clear portions of the negative may be eliminated by immersing in a 5 per cent. solution of sodium chloride.

## Chromium Intensifier

*A simple, easily controlled and satisfactory intensifier. This intensifier has met with increasing popularity, owing to the ease and certainty of its operation, and the permanency of the intensified image. It permits a considerable degree of intensification.*

SOLUTION A

| | | |
|---|---|---|
| Water ... ... ... ... ... | 10 ounces | 500 c.cm. |
| Potassium bichromate ... ... | 1 ounce | 50 grams |

SOLUTION B

Hydrochloric acid conc.

*WORKING DIRECTIONS.*—First, bleach the negative in a solution combining *A* and *B*, then blacken in a developer. By varying the proportion of *A* to *B*, the degree of intensification is changed.

FOR STRONG INTENSIFICATION

| | | |
|---|---|---|
| Solution A ... ... ... ... | ½ ounce | 12.5 c.cm. |
| Solution B ... ... ... ... | 5 minims | 0.3 c.cm. |
| Water ... ... ... ... ... | 4 ounces | 100 c.cm. |

FOR MODERATE INTENSIFICATION

| | | |
|---|---|---|
| Solution A ... ... ... ... | ½ ounce | 12.5 c.cm. |
| Solution B ... ... ... ... | 25 minims | 1.5 c.cm. |
| Water ... ... ... ... ... | 4 ounces | 100 c.cm. |

FOR SLIGHT INTENSIFICATION

| | | |
|---|---|---|
| Solution A ... ... ... ... | ½ ounce | 12.5 c.cm. |
| Solution B ... ... ... ... | ½ ounce | 12.5 c.cm. |
| Water ... ... ... ... ... | 4 ounces | 100 c.cm. |

After bleaching in one of the above combinations, wash the negative thoroughly, then blacken in an ordinary MQ developer, e.g., formula, page 10. So that the image is properly blackened, this process should be carried out in diffused daylight or strong artificial lighting. If a satisfactory density is not reached after one development, the process may be repeated as desired.

*REMARKS.*—Avoid dipping the fingers in the bleaching bath, except when protected by fingerstalls ; this applies particularly to hands with open cuts. Metal clips or holders must not come in contact with the bleaching bath.

## Converting Coarse-Grain Negatives

*When negatives are too hard and of coarse grain, owing to poor choice of developer or prolonged development, it is possible to improve the results by a process of bleaching and re-development. This method may also be used to advantage when the exposure conditions have necessitated the use of a very fast film of relatively coarse grain, in addition to a coarse grain developer. It should be pointed out, however, that this re-development method never produces such finegrain results as the recognised finegrain development.*

### A. BLEACHING BATH

| | | |
|---|---|---|
| Water ... ... ... ... ... | 20 ounces | 500 c.cm. |
| Copper sulphate ... ... ... | 2 ounces | 50 grams |
| Sodium chloride (common salt) ... | 2 ounces | 50 grams |
| Conc. sulphuric acid ... ... | ½ ounce | 12.5 c.cm. |

### B. RE-DEVELOPMENT

| | | |
|---|---|---|
| Water ... ... ... ... ... | 20 ounces | 500 c.cm. |
| Paraphenylenediamine ... ... | 26 grains | 1.2 grams |
| Sodium sulphite anhydrous ... | 200 grains | 10 grams |

*WORKING DIRECTIONS.*—First, bleach in solution **A**, then wash for a few minutes, and finally re-develop in solution *B*. The development should proceed until the image is blackened throughout, which can be verified by examination of the celluloid side of the film. At this stage, the negative scarcely appears any different from its original state, but directly it is immersed in an ordinary acid fixing bath, the image lightens and the gradation becomes considerably softer. Finally, wash the negative thoroughly.

# TONING AND GLAZING YOUR PRINTS

In toning distinction is made between the direct and indirect methods ; whereas with the former the black silver image is converted directly into a sulphide image, with the indirect method an intermediate bleaching bath is necessary.

With the selenium process, the selenium, when powdered, dissolves in the sulphide solution with a brownish colouring. The stock solution containing selenium keeps well, but in diluted form it deteriorates.

Make quite sure that the prints have been thoroughly fixed and washed, otherwise the tone may be uneven and the whites on the yellowish side.

## Selenium Toning

*This toner is best suited to chloro-bromide papers, which have been developed to a tone between warm-black and brown. In this formula the tones change to pure brown, sepia, or violet-brown, according to the nature and properties of the paper used. Chloride and bromide papers are not so well suited to this toner, since with these papers only a slight alteration in tone, usually towards a violet shade, is noticed. The formula is useful, however, to improve prints that show an unpleasant greenish black due to improper development.*

| | | |
|---|---|---|
| Sodium sulphite, anhydrous ... | 3 ounces | 75 grams |
| or crystalline ... ... ... | 6 ounces | 150 grams |
| Powdered selenium ... ... ... | 60 grains | 3 grams |
| Ammonium chloride ... ... ... | 7 ounces | 175 grams |
| Water to make ... ... ... | 20 ounces | 500 c.cm. |

*MAKING UP.*—First, dissolve the sulphite in about three-quarters of the total volume of water, and heat. Then add the selenium and boil until completely dissolved. When the solution has cooled, add the ammonium chloride and stir until dissolved. Finally, add cold water to make up the full volume.

*WORKING DIRECTIONS.*—Dilute 1 part of toner with 5 parts of water. The prints for toning should have been thoroughly fixed and washed. The toner takes 10–15 minutes and a brown-black to brown tone is obtained.

## Indirect Sulphide Toning

*Indirect sulphide toning is perhaps the most popular toning process. It necessitates two baths. In the first bath, the image is bleached, and in the second toned. Indirect sulphide toning is particularly suitable for enlarging paper, but not very satisfactory for chloride contact papers.*

### 1. BLEACHING BATH

| | | |
|---|---|---|
| Water ... ... ... ... ... | 20 ounces | 500 c.cm. |
| Potassium bromide ... ... ... | 200 grains | 10 grams |
| Potassium ferricyanide ... ... | 1 ounce | 25 grams |

### 2. TONING BATH FOR SEPIA TONES

| | | |
|---|---|---|
| Water ... ... ... ... ... | 20 ounces | 500 c.cm. |
| Sodium sulphide crystals ... ... | 200 grains | 10 grams |

### 3. TONING BATH FOR RED-BROWN TONES

| | | |
|---|---|---|
| Water ... ... ... ... ... | 20 ounces | 500 c.cm. |
| Sodium sulphide crystals ... ... | 200 grains | 10 grams |
| Selenium ... ... ... ... | 5 grains | 0.25 grams |

### 4. TONING BATH FOR PURE BROWN TONES

| | | |
|---|---|---|
| Water ... ... ... ... ... | 20 ounces | 500 c.cm. |
| Thiocarbamide solution, 5 per cent. | 4 ounces | 100 c.cm. |
| Potassium bromide solution, 10 per cent. ... ... ... ... ... | 16 ounces | 400 c.cm. |
| Caustic soda solution, 10 per cent. ... | 1 ounce | 25 c.cm. |

*MAKING UP.*—The preparing of sulphide solutions as well as the actual toning process, should not be conducted in the darkroom or in any room where light-sensitive material is stored. Sodium sulphide gives off hydrogen sulphide, which smells offensively and is extremely dangerous to every type of sensitive photographic material. The temperature of the water for making up may be normal, and in the case of solution **3**, stir or shake well in order to dissolve the selenium thoroughly.

*WORKING DIRECTIONS.*—Bleach the prints in solution **1** until there are only faint traces of the image in yellow-brown colour. Follow this by washing thoroughly, until the water does not show any colouring. Then immerse the prints in one of the toning baths according to the tone desired. Solution **4** has the advantage over **2** and **3**, in that it is odourless. Keep the prints in the toning bath, until no further change in image tone is noticeable (1–1½ minutes). Afterwards, wash thoroughly.

*REMARKS.*—Successful sulphide toning is dependent on the following factors : The prints must be fixed thoroughly, otherwise discolora-

tion of the whites occurs. Wash thoroughly, since traces of hypo in the bleaching bath form a reducer and affect the details in the image. The prints must be fully developed and show a good black image. Only in such cases will good deep tones be obtained.

## Red Chalk Tones

*Sulphide-toned prints may be immersed in a bath containing gold chloride to form reddish tones.*

SOLUTION A

| | | |
|---|---|---|
| Water ... ... ... ... ... | 16 ounces | 400 c.cm. |
| Hypo crystals ... ... ... ... | 350 grains | 17 grams |
| Thiocarbamide... ... ... ... | 350 grains | 17 grams |
| Potassium metabisulphite ... ... | 175 grains | 8.5 grams |

SOLUTION B

| | | |
|---|---|---|
| Water ... ... ... ... ... | 4 ounces | 100 c.cm. |
| Gold chloride ... ... ... ... | 18 grains | 1 gram |
| Precipitated chalk to cover the point of a knife. | | |

*MAKING UP.*—Mix the stock solutions A and B with an equal volume of water. The cloudiness caused by the chalk is of no consequence.

## Blue and Green Tones

*With method No.* **1**, *direct blue tones may be obtained, providing the prints have been suitably developed. The browner the tone of the original, the more blue will be the tone after the gold bath. It is therefore necessary for the prints to be developed in a brown developer similar to formula, page 18. The prints should be developed somewhat lighter than usual. Any print with black image tones is suitable for method No.* **2**, *whilst for lantern slides this method should be used in preference to method No.* **1**.

METHOD No. 1

Same formula as for red chalk tones (see above).

METHOD No. 2

A. BLEACHING BATH

| | | |
|---|---|---|
| Water ... ... ... ... ... | 20 ounces | 500 c.cm. |
| Potassium ferricyanide ... ... | 40 grains | 2 grams |
| Ammonia ... ... ... ... | A few drops | 0.1 c.cm. |

B. BLUE TONING BATH

| | | |
|---|---|---|
| Water ... ... ... ... ... | 20 ounces | 500 c.cm. |
| Ferric ammonium citrate ... ... | 175 grains | 9 grams |
| Hydrochloric acid ... ... ... | 26 minims | 1.5 c.cm. |

### C. SUPPLEMENTARY TONING BATH FOR GREEN

| | | |
|---|---|---|
| Water ... ... ... ... ... | 20 ounces | 500 c.cm. |
| Sodium sulphide crystals ... ... | 40 grains | 2 grams |
| Hydrochloric acid ... ... ... | 96 minims | 5 c.cm. |

*WORKING DIRECTIONS.*—Method **1** produces blue tones direct, but method **2** is indirect, and for the latter bleach the prints in solution *A*, wash thoroughly until the whites are clear, then tone blue in solution *B*, or for green tones in solution *C*. Wash well before and after green toning.

## Glazing Solution

*Preparing your own ox-gall solution is not recommended, since the prepared form can be purchased cheaply and is simply diluted with water for use. The best dilution for the prepared ox-gall will be given in the maker's instructions, but it is generally :*

| | |
|---|---|
| Ox-gall prepared ... ... ... | 1 part |
| Water ... ... ... ... ... | 10 parts |

*WORKING DIRECTIONS.*—Immerse the prints in the ox-gall solution for 5–10 minutes. After the glazing plate has been rubbed with a sponge dipped in the solution, place the prints on the plate, emulsion downwards, cover over with a rubber sheet or blotting paper, and squeegee with a roller or strip squeegee apparatus. Then stand the plate obliquely and allow the prints to dry without heat. When they are completely dry, they will fall off on their own accord, or easily peel off.

*REMARKS.*—From time to time, the plates should be cleaned with a paste made with French chalk, methylated spirit, and a few drops of ammonia. After this treatment, the plates should be washed with soap and finally with hot water. If the plates are not clean, prints are liable to stick and become damaged when being removed from the plate.

Another way of obtaining highly glazed prints, is instead of the ordinary plate glass, to use chromium plates in conjunction with an electrically heated drying machine, in this process the prints are dried in a few minutes. A preliminary treatment with ox-gall is not necessary, but the simple method with glass plates excels in producing a " mirror-surface " finish to the prints.

# DARK-ROOM HINTS

## Antidotes for Poisons

*AGAINST ACIDS.*—Alkaline drinks, i.e., *sodium bicarbonate, magnesium carbonate or a suspension of magnesium oxide.* If these are not available, then quantities of *warm water* to induce vomiting. *Milk* and *oil* may also be used.

*ACID SPLASHES IN THE EYES.*—Wash with *warm water* or with very dilute *sodium bicarbonate.*

*AGAINST CAUSTIC ALKALIS.*—Drink strongly *diluted vinegar* or *citric acid* or *apple juice.* Suck pieces of *ice. Milk* or *oil* may be taken.

*ALKALI SPLASHES IN THE EYES.*—Wash with *water* or very dilute *boric acid.*

*GAS POISONING.*—Fresh *air,* remove constricting *clothing,* artificial *respiration.*

*MERCURY POISONING.*—*Milk* and white of *egg.*

## Preventive and Ointment Against Dermatitis

As a preventive against dermatitis caused by metol to especially sensitive persons, the fingers may be rinsed both before and during development, but more especially after developing and before the use of soap in :

| | |
|---|---|
| Hydrochloric acid ... ... ... ... ... ... | 20 drops |
| Water ... ... ... ... ... ... ... ... | 20 ounces |

Where the skin is already affected, the following ointment should be used two or three times a day and before going to bed at night :

| | |
|---|---|
| Icthyol ... ... ... ... ... ... ... ... | 10 parts |
| lanoline ... ... ... ... ... ... ... | 40 ,, |
| Boric acid ... ... ... ... ... ... ... | 40 ,, |
| Vaseline ... ... ... ... ... ... ... | 30 ,, |

## Removing Developer Stain from the Hands

Rub the hands well with a 1 per cent. solution of potassium permanganate until they have taken on an overall *brown colour,* then wash well in the ordinary way and finally rinse in a strong solution of sodium bisulphite, which will completely remove the brown colour.

## Removing Developer Splashes from Clothes

Damp the spots or splashes with 5 per cent. solution of potassium permanganate. Allow to remain for a few moments and then decolorise with 10 per cent. solution sodium bisulphite.

In the case of *coloured cloth* or fabric care must be exercised, otherwise the treatment may cause the appearance of a bleached area.

## Cleaning Solution for Glass or Porcelain Vessels

| | | |
|---|---|---|
| Water ... ... ... ... ... | 40 ounces | 1,000 c.cm. |
| Potassium dichromate ... ... | 4 ounces | 100 grams |
| Sulphuric acid conc. ... ... ... | 4 ounces | 100 c.cm. |

Dissolve the dichromate first and then add the acid slowly and with constant stirring as great heat will be evolved. When this solution has been used, the vessels must be well *washed* with plenty of water.

## Releasing Jammed Glass Stoppers

Quickly but carefully warm the neck of the bottle with a gas or spirit lamp flame. Then tap the stopper with a piece of wood until loosened. Where the jamming of the stopper is due to crystallising of salts out of solution, a drop or two of water is a help, or the bottle may be inverted and placed in warm water up to the neck of the bottle.

# PHOTOGRAPHIC CHEMICALS

In the following pages, details are given of the more important photographic chemicals and are arranged as follows.

(1) The common *name* of the chemical, other names in use and chemical composition.

(2) *Appearance, method of preserving, special properties, i.e.*, poisonous, corrosive or inflammable. *Solubility* in water at normal temperature.

(3) *Use* for photographic purposes, usually with page references.

ACETIC ACID GLACIAL.
Water clear fluid with stinging smell. Solidifies at low temperatures (below 50° F. (10° C.) ). Keep in glass-stoppered bottle ; corrosive action.
Mixes in all proportions with water.
Used for stop bath (p. 29), addition to fixing baths (p. 30 and in uranium intensifier (p. 41).

ALUM. POTASH. Aluminium potassium sulphate. Rock alum.
Colourless transparent crystals or white powder. Corked bottle.
Solubility 1 part in 10–11 parts water.
Used as hardening agent (p. 41), also in hypo-alum toning.

ALUM CHROME. Chromium potassium sulphate.
Deep violet crystals. Corked bottle.
Soluble 1 part in 5–7 parts water.
Used as hardening agent (p. 14).

AMIDOL. 2.4-Diamino-phenol hydrochloride.
White to greyish needle crystals. Keep in brown glass bottle with well-waxed cork.
Strong developer without alkali (p. 15).

AMMONIUM PERSULPHATE.
Colourless crystals. Glass-stoppered bottle.
Soluble 1 part in 1.7 parts of water.
As reducer (p. 41).

BORAX. Sodium biborate.
White powder or crystals. Corked bottle.
Soluble 1 part in 17 water.
As mild alkali in finegrain developers (p. 12).

CALGON. Presumably sodium hexa-metaphosphate.
White powder or colourless crystals. Corked bottle.
As preventative to precipitation of calcium salts in hard water.

COPPER SULPHATE. Blue vitriol.
Blue crystals, caustic and poisonous, corked bottle.
Soluble 1 part in 3 water.
As bleach bath (p. 43).

FORMALINE. Solution of gaseous formaldehyde in water.

Water clear but faintly yellowish solution, poisonous with unpleasant smell. Vapour dangerous to light sensitive material. Brown glass-stoppered bottle.

Miscable in all proportions with water.

As hardening agent when diluted with water (p. 31).

HYDROCHLORIC ACID. Muriatic acid. Spirits of salts.

Colourless when pure, but often yellowish. Corrosive and poisonous. Vapour dangerous to photographic materials. Glass-stoppered bottle.

In toning baths (p. 46), also for cleaning dirty vessels.

HYDROQUINONE. Quinol. Paradihydroxybenzene.

Colourless crystals. Brown glass bottle with well-waxed cork.

Widely used developer (pp. 10, 13, 16, 25, 26).

MERITOL.

A fine grain developer, rapidly soluble and without the toxic properties of Paraphenylediamine.

METOL. Elon. Pictol. Genol. Scalol. Rhodol. Methyl para-aminophenol sulphate.

Colourless needles or prisms. Brown glass bottle with well-waxed cork.

Developer of universal applicability (pp. 10, 11, 12, 14, 16, 25).

PARAPHENYLENEDIAMINE. 1.4-Diaminobenzene.

White to brownish powder. Poisonous. Brown glass bottle with waxed cork.

Used in finegrain developers (p. 43).

POTASSIUM BROMIDE.

White cubic crystals or white powder. Corked bottle.

Soluble 1 in 1.6 water.

Restrainer in developers (pp. 10, 11, 12, 13, 14, 16, 25, 26), also in bleaching baths.

POTASSIUM DICHROMATE. Bichromate of potash.

Orange red crystals, poisonous. Corked bottle.

Soluble 1 part in 10 water.

For cleaning vessels (p. 49).

POTASSIUM FERRICYANIDE. Red prussiate of potash.

Dark red crystals, poisonous. Corked bottle.

Soluble 1 in 2.5 water.

As reducer (p. 32).

POTASSIUM HYDROXIDE. Caustic potash.

Appears in sticks, flakes and pellets, strongly corrosive and attracts moisture. Bottle with rubber stopper.

Extremely soluble in water, 1 in 0.5.

Strong alkali for developers (p. 13).

POTASSIUM METABISULPHITE.

Colourless, hard crystals. Corked bottle.

Soluble 1 in 3 water.

As preservative in developers, stop bath, as acidifier in fixing baths (p. 29).

POTASSIUM SULPHOCYANIDE. Potassium thiocyanate. Potassium rhodanate.

Colourless crystals, poisonous. Brown glass-stoppered bottle.

Soluble 1 in 0.5 water.

Addition to fine-grain developers (p. 12).

SODIUM BISULPHITE.

White crystalline powder. Sulphurous acid smell. Glass-stoppered bottle.

Soluble 1 in 4 water.

Used for same purposes as potassium metabisulphite.

SODIUM CARBONATE. Soda. Carbonate of soda.

White crystals or powder. Corked bottle. Crystal carbonate.

Soluble 1 in 1.6 water, anhydrous 1 part in 6 water.

Used as alkali in developers (pp. 11, 12, 16, 25, 26).

SODIUM CHLORIDE. Common salt.

White powder. Corked bottle.

Soluble 1 in 2.5 water.

Addition to copper bleach bath (p. 43).

SODIUM HYDROXIDE. Caustic soda.

In sticks, flakes and pellets, strong caustic. Glass bottle with rubber stopper.

Soluble 1 in 1.7 water. (Generates heat on dissolving as does caustic potash.)

Strong alkali for developers and toning bath (p. 45).

SODIUM SULPHATE. Glaubers salts.

Colourless crystals. Corked bottle.

Soluble 1 in 2 water.

As addition to tropical developer (p. 14).

SODIUM SULPHITE.

White powder or crystals. Corked bottle.

Anhydrous salt soluble 1 in 5 water.

Preservative in developers (pp. 10, 11, 12, 13, 14, 16, 25, 26, 30, 43, 44).

SODIUM THIOSULPHATE. Hypo. Sodium hyposulphite.

Colourless crystals. Corked bottle.

Soluble 1 in 0.7 water.

The universal fixing material (p. 29, 30).

SULPHURIC ACID. Oil of vitriol.

Colourless oily liquid. Strong corrosive and poisonous. Glass-stoppered bottle.

*Caution :* When dilute acid is required, the acid must always be poured into the water, never the reverse, otherwise the reaction attains explosive violence.

Used for bleach baths (p. 43), cleaning solution (p. 49).

URANIUM NITRATE. Uranyl nitrate.

Yellowish crystals. Poisonous. Glass-stoppered bottle.

Soluble 1 in 0.5 water.

Used in uranium intensifier (p. 41).

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## Dr. C. I. JACOBSON

Is thirty-six. Took his Doctorate in photographic research. Holds a large number of photographic patents and is acting as a consulting engineer for many firms in the photographic industry. He has invented, designed, improved exposure meters, X-ray cameras, enlargers, filters, films, papers, developers, all sorts of photographic chemicals and threatens to do even more in the future. Has written some books on photography and was for many years editor of a photographic paper. He insists that he is a technician, although nobody has yet mistaken him for an artist !

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